



Exploring Comets and Modeling for Mission Success



Activity Purpose and Goals

Created for the Deep Impact Mission, A NASA Discovery Mission

Maura Rountree-Brown and Art Hammon

Educator - Enrichment

Purpose:

The purpose of this workshop activity is to give educators information and activities surrounding the basics of comet science. Students get the opportunity to follow the path science has taken throughout history to explore comets. They'll also learn about how we are currently exploring comets and why projects perform modeling exercises on Earth in order to assure mission success in space. Students will understand the physical and chemical properties of comets as we presently understand them.

Goals:

Students will:

- ☐ - Have the chance to interact with the rest of the class discussing theories on the formation and nature of comets
- ☐ - Add and eliminate new facts as they incorporate experiment and theory
- ☐ - Make an ice cream model to visualize comet formation and the technologies used in comet space missions
- ☐ - Progress from talking about comets to creating models to test their own space designs and comet theories
- ☐ - Begin with questions and perceptions about comets and progress to building their own solid base of comet knowledge

Educators will:

- ☐ - Enhance their information about comets in general and the Deep Impact mission in particular
- ☐ - Integrate historical information into classroom lessons that relate comets to the lives of people
- ☐ - Employ a model for simulating comet formation and composition using ice cream and another, using a comet model on a stick that gives their students an exercise in evaluation and modification as a common space mission practice
- ☐ - Encourage communication among students using prompts about comet characteristics and formation
- ☐ - Use resources that encourage thinking, discussion and writing about comet structure and behavior
- ☐ - Better understand the mechanics of ice crystal formation and micro-crystal formation in ice cream

Program Description:

Comets have caught the attention of people on Earth from earliest recorded history. Students duplicate the sequential path scientists have taken throughout history to research comets.

- First, they learned by looking up in the sky and through the drawings of others. They guessed about comets.
- Then, they learned by using their knowledge of math, science and eventually using emerging technologies. They began to discover information about the patterns and to understand the elements of comets.
- Now they learn through space exploration. Robotic spacecraft visit comets. Mission teams model cometary environment on Earth to test challenges to their mission design and find solutions.

Students have the opportunity to:

- Elicit #1 - Think how they would initially define a comet based on their current knowledge and possible misconceptions
- Elicit #2 - Model an “ice cream comet” to learn about some of the elements that make up a comet and add to their base of knowledge through new information
- Elicit #3 – Discuss why scientists explore comets and what value they might have to us in the future
- Elicit #4 – Choose the information they might investigate about comets and design the mission they would use
- Elicit #5 – Discuss modeling for the success of a mission and create models for their mission design and comet environment
- Elicit #6 – Research current comet space missions and their technologies

There are many reasons to explore comets both for knowledge and for future resource and protection of the Earth. The underlying goal for this activity is to lead the student from casual observation to an involvement and ownership in comet science.

For the Educator:

The following workshop materials are provided:

For Educators:

- *“Exploring Comets - Activity Purpose and Goals”*
- *“Comet Activity Overview” (activity outline, order of activity)*
- *“Make a Comet Model and Eat it!” – Educator page*
- *“Deep Impact’s Comet on a Stick!” – Educator page*
- *“Questions from Past Workshops” – Discussion or student test*

For Students/Educators:

- “Consider this” history page
- “A Comet’s Place in the Solar System”
- “Exploring Comets – Student reflection page”
- “Make a comet model and eat it” Activity
- “Make a comet model and eat it – Student Data Sheet”
- “Chemistry of Ice Cream Activity”
- “Ten Important Comet Facts” – Facts about comets
- “C-O-M-E-T-S – Acrostic” – Facts about comets
- “Deep Impact’s Comet on a Stick” – Activity
- “Paper Comet with a Deep Impact” – Optional Activity
- “Comet Models based on the Deep Impact Mission” – Activity
- “Deep Impact – Interesting Facts” – mission background
- Educator/Students – “Small Bodies Missions” resource page
- Optional Extension activities from the Stardust comet mission are found at <http://stardust.jpl.nasa.gov/classroom/guides.html>

You will need to provide:

- Materials for the “Make a comet and eat it”, “Comet on a Stick!”, or other activities you choose from this package
- Household or arts and crafts items to make comet models
- Poster board and pens or enough blackboard space to retain several class discussion lists
- (Optional) Computer to look up mission web sites for research

Questions? – Contact Maura Rountree-Brown Maura.Rountree-Brown@jpl.nasa.gov or Art Hammon – Pre-College Education Specialist, JPL ahammon@jpl.nasa.gov
The Deep Impact web site: <http://deepimpact.jpl.nasa.gov> or <http://deepimpact.umd.edu>